

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 131408

Roll No. 

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**B.TECH.****Theory Examination (Semester-IV) 2015-16****INFORMATION THEORY AND CODING****Time : 3 Hours****Max. Marks : 100****Note: Attempt questions from all Sections as per directions.****Section-A****Q1. Attempt all parts of this section. Answer in brief.****(2×10=20)**

- (a) Derive the relation between conditional and joint entropies.
- (b) What is DMC? Explain its significance.
- (c) Give difference between digital audio and audio compression.
- (d) Briefly explain Run Length Encoding (RLE). State its examples.
- (e) Compare and contrast Huffman coding and arithmetic coding.

- (f) If  $C$  is a valid code vector, then prove that  $CH^T = 0$  where  $H^T$  is transpose of parity check matrix  $H$ .
- (g) Explain in brief the Golay code.
- (h) State the limitations of sequential decoding.
- (i) What is ARQ? State its types.
- (j) Differentiate among Code rate, Constraint length and Code dimension.

### Section-B

**Q2. Attempt any five questions from this section. (10×5=50)**

- (a) Prove that the upper bound on the value of entropy  $H$  of a source is  $\log_2 M$ , where  $M$  is the number of symbols.
- (b) For a discrete memory less source there are three symbols with probabilities  $p_1 = \alpha$  and  $p_2 = p_3$ . Determine the entropy of the source and sketch its variation for different values of  $\alpha$ .
- (c) Define and explain the term information rate. State the relation between information rate and entropy.
- (d) Design a syndrome calculator for a (7, 4) cyclic Hamming code generated by the polynomial  $G(p) = p^3 + p + 1$ . Calculate the syndrome for  $Y = (1\ 0\ 0\ 1\ 1\ 0\ 1)$ .
- (e) State and explain source coding theorem. What is coding efficiency?

(2)

- (f) A channel has the following channel matrix.?

$$[P(Y/X)] = \begin{pmatrix} 1-p & p & 0 \\ 0 & p & 1-p \end{pmatrix}$$

- (i) Draw the channel diagram.
- (ii) If the source has equally like outputs. Compute the probabilities associated with the channel output for  $p=0.2$ .
- (g) Determine For the given code shown in figure 1 obtain the convolution code for the bit sequence 1 1 0 1 1 0 1 1 and decode it by constructing the corresponding code tree.

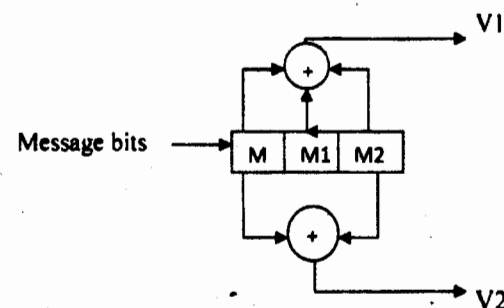


Fig.1

- (h) Explain VRC and LRC techniques. Define minimum distance  $d_{min}$  and explain its role in detecting and correcting errors.

(3)

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### Section-C

Attempt any two questions from this section. (15×2=30)

- Q3. With the following symbol and their probability of occurrence, encode the message "went#" using arithmetic coding algorithms.

Symbol	e	n	w	t	'#'
Probability	0.3	0.3	0.1	0.1	0.1

- Q4. For the joint probability matrix (JPM) shown below,  $H(X,Y)$ ,  $H(X)$ ,  $H(Y)$ ,  $H(X/Y)$  and  $H(Y/X)$

$$\begin{pmatrix} 0.2 & 0 & 0.2 & 0 \\ 0.1 & 0.01 & 0.01 & 0.01 \\ 0 & 0.02 & 0.02 & 0 \\ 0.04 & 0.04 & 0.01 & 0.06 \\ 0 & 0.06 & 0.02 & 0.2 \end{pmatrix}$$

- Q5. How do you obtain the generator polynomial for the cyclic code? Check if the following codes are cyclic or not

$$\text{Code } X_1 = \{0000, 0101, 1010, 1111\}$$

$$\text{Code } X_2 = \{0000, 0110, 1001, 1111\}$$